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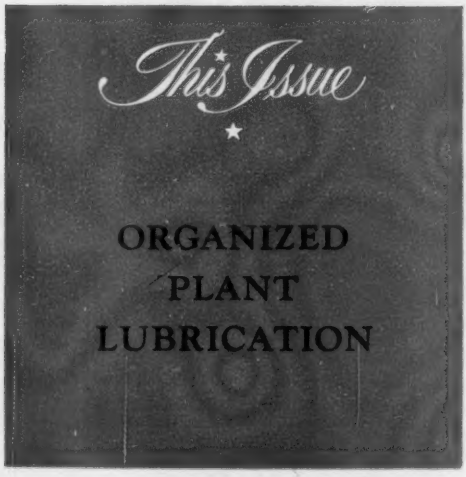
Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants



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LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

Published by
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ORGANIZED PLANT LUBRICATION

TODAY, more is being said, written, and done about organized plant lubrication than ever before. The current interest and enthusiasm in this subject is not due to some sudden impulse. It is simply the culmination of a slow but steady awakening of all concerned, including plant managements, to the many facets and ramifications of plant lubrication and the benefits to be derived from an efficient lubrication program.

WHAT IS ORGANIZED LUBRICATION?

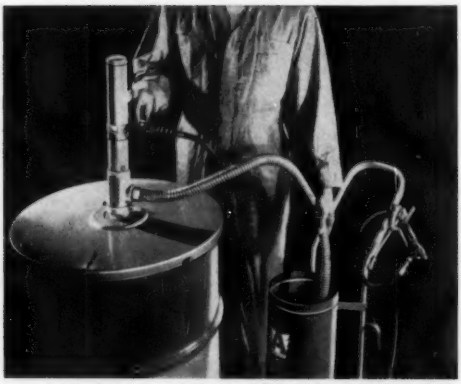
As has been pointed out by so many, so often, ideal lubrication is achieved by applying the *right amount* of the *right lubricant* to the *right place* at the *right time*. Although this is simple in principle, it frequently is quite complex to put into practice.

Many factors are involved in the lubrication of industrial equipment, some of which are readily apparent while others are more obscure. Some of the major factors include, (a) determination of the lubrication requirements of the equipment, (b) selection and purchase of lubricants, (c) storage and handling of lubricants, (d) application of lubricants, and (e) preventive maintenance practices. In its broadest sense, organized lubrication simply represents a concerted effort to co-ordinate and consolidate all of these factors in such a manner as to make the practice of lubrication conform as nearly as possible to the ideal. This will not happen by chance. It will not occur automatically. It can be accomplished only by careful planning, design, and supervision.

BENEFITS OF AN ORGANIZED LUBRICATION PROGRAM

Establishing a sound, efficient lubrication program is not necessarily an easy task. In fact it can be quite complex and involve the expenditure of considerable time, effort and even money. Is it worth it? Even under the most haphazard, disorganized circumstances, the various elements relating to lubrication might be performed. Lubricants could be purchased, right or wrong, and somehow or other the equipment might be lubricated and kept running most of the time. What, then, is to be gained by going to the trouble and perhaps expense of setting up an elaborate lubrication program?

The benefits to be realized from an organized lubrication program are both substantial and far reaching, and what is more important, they can be translated directly into *cash savings*. This is not just wishful thinking. Neither is it theoretical speculation. It is an established fact. More evidence is being accumulated every day to substantiate these claims. In some cases, the savings that have resulted are almost beyond belief. Some typical case histories will be discussed briefly later. In order to give



Courtesy of Alemite Div. Stewart-Warner Corp.

Figure 1 — Product being transferred from original drum to smaller container by means of a transfer pump. One of the best chances for a lubricant to become contaminated is during the interval when it is being transferred from its original container to the point of application. Wherever possible, it is best to apply the lubricant directly from the container in which it was received. Where intermediate handling is necessary, an arrangement similar to that shown above should be used. Notice the drum is covered to protect the lubricant from contamination, and the smaller container is one which is intended to be used for this purpose and this purpose alone.

some idea of the order of magnitude of these benefits, savings in operating costs equivalent to from 10 to 100 times the purchase price of the lubricants themselves have been reported. Where do savings of this magnitude appear? Actually, they show up in numerous areas, some of which are as follows:

Savings in Cost of Lubricants

Although a good lubrication program will make use of quality lubricants which may have a higher unit price than the products used previously, the total cost of lubricants usually is less because the quantity used is smaller. The decreased amount used results mainly from less waste due to proper handling and application techniques and to longer life of the quality lubricants. For hydraulic use for example, experience has shown that a premium type lubricant, inhibited against rust, oxidation and foam, will have a service life at least five times greater than a highly refined straight mineral oil.

Savings in Maintenance Costs

The cost of maintaining equipment represents a substantial portion of the total cost of operating a plant. Here is an area where the benefits of a lubrication program can be realized soon after the program gets underway. The role of good lubrication practices in reducing maintenance costs is not always understood and consequently is frequently underestimated by those concerned. Actually, the difference between maintenance costs associated with good lubrication practices and the corresponding costs associated with bad lubrication practices is, in many cases, phenomenal.

Savings Due To Decreased Downtime

Nonscheduled shutdowns of machines can be very costly. Not only do repairs and maintenance represent out-of-pocket costs, but an idle machine does not produce. This means loss of production, loss of sales, and loss of profits. In a plant which is highly automated, where machine operations are closely integrated, it is mandatory that downtime be reduced to an absolute minimum. Proper lubrication is one of the best means of keeping the equipment going and saving the high costs of downtime.

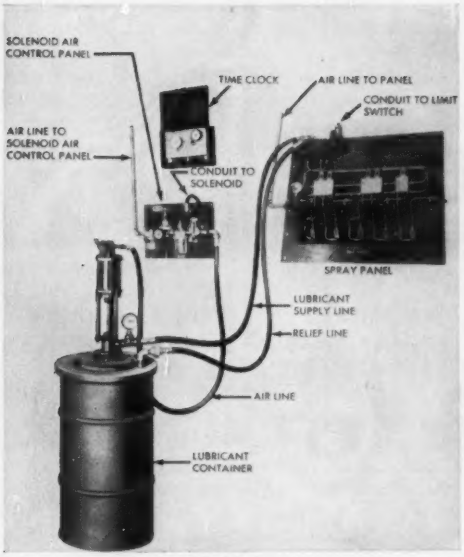
Savings Due To Fewer Rejects

Parts that must be rejected because they don't conform to specifications represent an item of considerable expense. Even though they may be salvaged by reworking, handling and production costs have been increased. A reject represents an "almost but not quite." Usually, the difference between acceptance and rejection is extremely small. Not always, certainly, but in many cases, this difference is due to some erratic operation of the equipment which could have been prevented by proper lubrication.

Savings Due To Increased Equipment Life

A piece of machinery represents a sizeable investment. In order to realize the greatest return on this investment, it must be kept in service as long as possible. It has been well established that proper lubrication combined with good preventive maintenance practices is the most effective means of extending equipment life.

These, then, are some of the areas where the benefits of organized, intelligent lubrication are converted directly into substantial cash savings. There are also other benefits which are just as real but upon which it is difficult to place a monetary value. One doesn't normally associate lubrication with morale, but the two are very definitely tied together. Proper lubrication will go a long way toward improving production and general plant operations. A smooth running plant is likely to be a happy plant. The personnel will take more of an interest in their work. Morale will be high. Furthermore, a plant of this type will be a safe plant. It is much less likely to be a breeding ground for accidents.



Courtesy of The Farval Corporation

Figure 2 — Typical automatic spray system layout.

Thus, the benefits to be realized from a controlled, organized lubrication program are many and varied, both tangible and intangible. In practically every case on record, the results obtained from a planned lubrication program have been most gratifying and have exceeded by far the most optimistic expectations.

THE ROLE OF MANAGEMENT

Any project, such as a planned lubrication program, whose success depends upon the close cooperation among personnel in different groups or departments, must have the sound backing and general supervision of management. Management must recognize the necessity of such a program and everyone up and down the line should be aware of it.

The failure of management to appreciate the full significance and overall benefits of planned lubrication has been the main reason why it has taken so long for the principle of organized plant lubrication to gain acceptance. Not being lubrication experts, management can hardly be expected to be familiar with all of the aspects of lubrication and to recognize instinctively the differences between good and bad lubrication practices and the consequences of each. To many, one lubricant is the same as another and price is the determining factor. Others may recognize that there are differences among lubricants but assume that the purchase of proper lubricants automatically assures that proper lubrication will be achieved.

Consequently, management must be sold on the fact that organized lubrication is actually a tool for saving money and at the same time a means of improving operations in general. It must be brought home to them that attempting to promote savings solely through the purchase price of lubricants is false economy. It must also be made clear that the mere purchase of the best lubricants will not in itself assure satisfactory lubrication. They must realize all of the factors associated with plant lubrication and understand that organized lubrication means controlling and coordinating all of these factors. Finally, they must be convinced that the merits and benefits to be gained from organized lubrication are real and significant and are well worth the time, effort and investment that may be involved in establishing such a program.

WHO CAN BENEFIT FROM ORGANIZED LUBRICATION

It is generally assumed that organized lubrication is intended only for the larger plants. This is an utter misconception. There are no limits to the size of a plant that can take advantage of planned lubrication. The benefits can be enjoyed by the small and large alike. Actually, percentage-wise the savings realized by relatively small plants frequently are greater than those recorded by the larger plants.

RESPONSIBILITY

Once management has decided to embark upon a planned lubrication program, the responsibility for organizing and administering the program must be specifically delegated. This is an extremely important assignment. The ultimate success of the project will depend upon establishing a sound, carefully conceived plan and following it to the letter. The job requires a specialist.

A lubrication engineer is the obvious choice for this assignment. He is well grounded in both the theory and practice of lubrication, and consequently he is well qualified to design and administer a plant lubrication program. Are the potential savings and over-all benefits anticipated of such magnitude as to justify the salary of a full time lubrication engineer? This is an obvious question and the obvious answer is that it depends upon the size of the plant. Although there are no hard and fast rules in this regard, it is generally agreed that plants with an annual budget of $100,000 or more for production maintenance can use a full time plant lubrication engineer to advantage.

For smaller plants which may not be able to justify a full time specialist, a maintenance superintendent or foreman is the logical choice to head up the program. Although the principles involved

SIMPLIFIED LUBRICANT RECOMMENDATIONS FOR MACHINE TOOLS

Parts To Be Lubricated	*Approximate Grade (Unless Otherwise Shown in Sec. Say. Univ. Viscosity)*	*Product Type**	*Product Description*
Hydraulic System			
Low Viscosity Medium Viscosity	150 at 100° F. 300 at 100° F.	1	High quality lubricant inhibited against rust, oxidation and foam
General Machine Lubricant			
Low Viscosity Medium Viscosity High Viscosity	200 at 100° F. 300 at 100° F. 500 at 100° F.	1	High quality mineral oil inhibited against rust, oxidation and foam
Gears (Not lubricated by general machine lubricant)			
Lightly Loaded — Other Than Worm	SAE 90 or 140	2	High quality mineral oil
Heavily Loaded — Including Worm Gears	SAE 90 or 140	3	Lead soap base, non-corrosive, mild type, extreme pressure lubricant
Spindles			
Oil Lubricated			
By Oilers and Wick Feed By Ring Oiler By Circulating of Flood System By Oil Mist	100-200 at 100° F. 200-300 at 100° F. 40-300 at 100° F. 40-150 at 100° F.	1	High quality mineral oil inhibited against rust, oxidation and foam
Grease Lubricated	NLGI Grade No. 2	4	Premium grade anti-friction bearing grease, highly resistant to oxidation
Ways			
Medium Viscosity High Viscosity	300-500 at 100° F. 700-1000 at 100° F.	5	Oils containing oiliness and extreme pressure qualities, as well as ability to withstand squeezing out
General Grease Lubrication			
Normal Operation	NLGI Grade No. 2	4	Premium grade anti-friction bearing grease, highly resistant to oxidation
Heavy Duty Operation	NLGI Grade No. 2	4	Ditto or Heavy Duty Type where required
Dual and Tri Purpose Oils for Multiple Spindle Automatic Screw Machines			
Dual Purpose — Machine Lubricant and Cutting Fluid Tri Purpose — Hydraulic Fluid, Machine Lubricant and Cutting Fluid	150 at 100° F. 250-300 at 100° F.	6	High quality non-corrosive oil of proven Dual or Tri purpose ability

*This is merely an arbitrary classification to distinguish the six different types of lubricants.

Figure 3 — Simplified Lubricant Recommendations for Machine Tools.

in designing a lubrication program are the same regardless of the size of a plant, the details are much easier to work out for a small plant than for a large one. In setting up the program itself, advantage should be taken of the lubrication engineering service offered by the lubricant supplier, whose lubrication engineers are well versed in all phases of plant lubrication and can be of great assistance in planning an efficient lubrication program. Once a program has been established, it can be administered by the maintenance foreman or superintendent.

ORGANIZING THE PROGRAM

As pointed out earlier, the broad objective of planned lubrication is to make the practice of lubrication approach the ideal – the ideal being defined as the application of the right amount of the right lubricant to the right place at the right time. The actual program and the mechanism for carrying it out will, of necessity, vary from plant to plant. No one master plan can be devised which will be universally acceptable and fit all situations. A plan that works successfully in one plant may be entirely unsatisfactory in another. Any program must be tailor-made to fit both the needs and the operating structure of a given plant. Generally, the more detailed the plan, the easier will be the execution and the less chance for mistakes. Obviously, a program which has to be carried out by inexperienced personnel of the lowest job classification will have to be spelled out in much greater detail than one which will be conducted by personnel with greater training and experience.

Despite the fact that details may vary, there are certain objectives and goals which should be common to all plans. Some of these will be discussed briefly.

Lubrication Survey

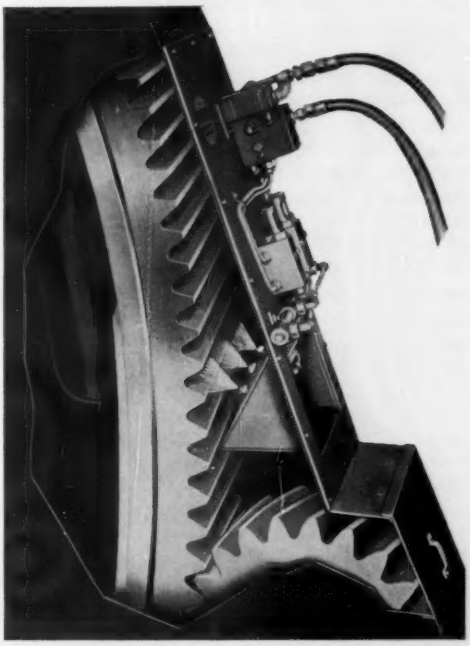
Among the first steps in organizing a lubrication program is that of making a complete survey of the lubrication requirements for all of the equipment in the plant. One of the best means of accomplishing this is to prepare a master card or sheet for each individual machine. The machines should be properly identified and their location in the plant specified. In some cases, as for example a plant which has many machines of the same type, confusion can be avoided by assigning a numerical identification to each machine. It is advisable to prepare metal tags or plates containing the same identification information recorded on the cards and attach them to a conspicuous spot on the corresponding machines.

All of the information relating to the lubrication of a machine should be recorded on the cards, including a listing of the parts to be lubricated, the types of lubricants required, the frequency of application, and any other pertinent data. These combined cards represent the lubrication guide for the whole plant and should be filed or bound together. They can be used to prepare plant lubrication schedules and also to keep a record of any maintenance work performed on the machines.

Selection of Lubricants

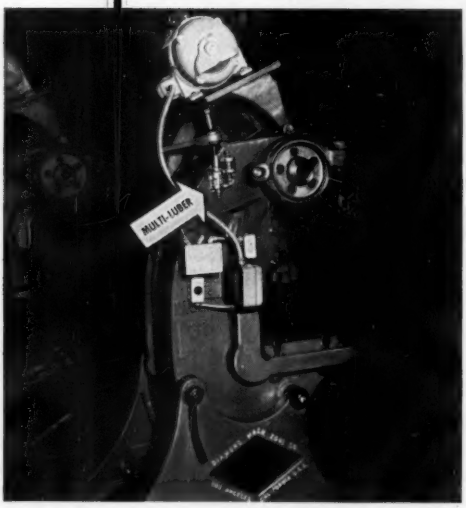
The selection of lubricants is a subject in itself and a discussion of the relative merits of the various methods used is beyond the scope of this article. Nevertheless, regardless of whether they are selected by brand name, specification, or some other means, the keynote should be *consolidation*. Unless a concerted effort is made to prevent it, a plant invariably will use many more lubricants than are actually required, and the situation gradually becomes worse as time goes on. It seems to be a natural tendency to add new lubricants without discontinuing any of those already in use. This increases the bookkeeping and other paper work, complicates the storage and handling problem and increases the chances for misapplication of lubricants.

Consolidation of lubricants must be accomplished



Courtesy of The Farval Corporation

Figure 4 – Schematic cutaway showing spray valve – lubrication coverage of a typical gear and pinion installation.



Courtesy of Lincoln Engineering Co.

Figure 5 — Installation of a push button controlled multiple lubrication system.

by an intelligent approach. It cannot be done haphazardly. The basic lubrication requirements of the equipment must always be kept in mind. When reducing the number of lubricants in use in a plant, the consolidation should always be made in favor of the quality products. For example, consider the case where a premium type oil containing rust and oxidation inhibitors is required for machines being lubricated by a central circulating system, and a straight mineral oil of the same viscosity is being used for machines being lubricated by oil cups. By using the premium product for both applications, the basic lubrication requirements for all of the machines involved would still be fulfilled, the number of lubricants would be reduced by one, and the chance of the straight mineral oil being used where the premium quality product was required would be eliminated. Although this consolidation would undoubtedly increase the unit cost of the lubricant used on the machines serviced by the oil cups, experience indicates that this increase would be more than overbalanced by the over-all savings that will result from reducing the stocks. Experience has also demonstrated that when a real effort is made to consolidate lubricants in a plant, usually the number of products used can be reduced by at least fifty per cent and frequently more.

Storage and Handling of Lubricants

The petroleum supplier takes every precaution necessary to assure that lubricants are in the best possible condition when delivered to the customer. The user, likewise, should exercise equal care to see that when the lubricant is applied, it is in the same good condition as when it was received. Normally, lubricants are not "prima donna" products which require unusual care. However, there are certain things that can occur during storage and handling which lead to waste, cause safety hazards and may render the lubricant ineffective, thus resulting in lubricant failure, increased maintenance cost and lost production. It is first necessary to recognize the bad practices and then take the rather simple, precautionary measures to avoid them. With this accomplished and with qualified personnel in charge of the handling of lubricants, there is every assurance that the lubricant will be in satisfactory condition when applied.

There are some basic rules and some "do's" and "don't's" which apply to all storage and handling operations. The following suggestions should be helpful in this regard:

(1) Choose storage area carefully. Select a central location so that hauling distances are as short as possible. Also select an area where the atmosphere is free from dust and vapors.

(2) Store lubricants indoors if possible — chances of contamination will be less.

(3) If stored outdoors, drums should be placed on their side and on racks — don't lay them on the ground. If placed upright on end, rain water may accumulate and be sucked into the drum by the normal atmospheric breathing action. If stored outdoors on end even temporarily, a waterproof cover should be placed over the drum.

(4) Indoor storage area, whether a separate building or whether it is a shared space, should be fire-proof, have brick, tile or concrete walls and floors, and be fitted with suitable drains. Woodwork, in addition to not being fire-proof, is more difficult to keep clean.

(5) Cleanliness is essential regardless of whether storage is indoors or outdoors. For indoor storage, the area should be painted in light colors, preferably white, and a regular cleaning schedule maintained.

(6) Orderliness is another must. By keeping different brands and types of lubricants separated and in their proper places, there is less chance for confusion and error.

(7) Exercise extreme care in heating products that have been exposed to low temperatures. If possible, transfer drums to a warm area and allow product to reach room temperature. If more rapid heating is required, use exhaust steam. Never apply direct heat, such as a flame, to the exterior of the drum. This would melt the drum's sealing compound and cause leaking. It might also harm the product.

(8) Remember that exposure to temperature extremes can damage some lubricants. If there is any reason to suspect that this condition has occurred, examine the lubricant before using. If the product appears abnormal, consult the lubricant supplier. The lubricant may have to be discarded or it may be salvaged.

(9) Whether the plant be small or large, the dispensing of lubricants should be supervised by personnel who are thoroughly familiar with lubricants and lubricant requirements. This is a vulnerable link in the chain of operations that connect the source of the lubricant with its application.

(10) The actual mechanics by which the lubricant is transferred from its storage container to the point of application, and the transfer equipment used, will depend upon the particular plant involved. Transfer pumps are available which fit the standard grease or lubricant drums and permit the product to be removed from its original container with no danger of contamination, waste, or mess. By means of such pumps, lubricants can be transferred to smaller units such as portable power guns, hand guns or small containers, and thence to the point of application.

Schemes can be devised for applying the lubricant directly from the drum, thus eliminating the intermediate transfer operation. For example, a drum equipped with a pump, hose, and control valve can be mounted on a dolly and brought directly to the spot where the lubricant is needed. Also a system can be devised whereby the lubricant is piped from the drum to the area where it is required, and hoses connected to the pipe outlets carry the lubricant directly to the machine.

Even for equipment which utilizes a centralized lubricating system, arrangements can be made to transfer the lubricant directly from its original drum.

(11) All equipment used in transferring lubricants should be located in a central spot and should be kept clean.

(12) Where many different lubricants are used, a simple code system can help avoid confusion. The code, whether it be alphabetic or color (be careful of color-blindness) should be clearly evident on the drum, the transfer equipment and the point of application.

(13) Keep accurate records of the lubricants used and use old stock first.

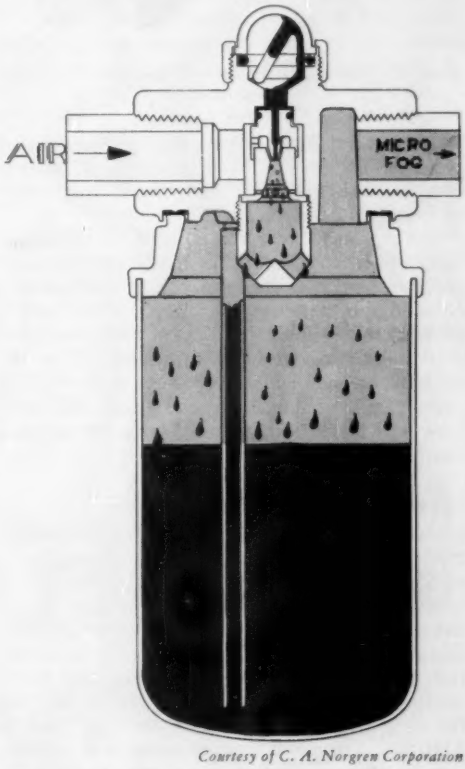
(14) Keep the oil dispensing area clean — don't let spills or drips accumulate — they are a safety hazard.

(15) Keep fire protection equipment handy and in operable condition.

Application of Lubricants

Application of lubricants is also a subject in itself, a full discussion of which is beyond the scope of this article. Nevertheless, it is one of the most important features of any successful lubrication program. The best lubricant in the world is of no value until it is applied properly to the bearings, gears or other surfaces requiring lubrication.

For the older type machines, manual methods of application, although far from ideal, can be used satisfactorily if the number of points to be lubricated are few and the frequency of application is not particularly critical. The design of modern machines practically precludes the use of these antique methods of application. Not only are the bearings in today's machines far more numerous, but they are precision-built to operate under much more severe conditions. Controlled lubricant application — the right amount at the right time — is essential. It is just too much to expect even the most conscientious oiler to locate every point that



Courtesy of C. A. Norgren Corporation

Figure 6 — Schematic cutaway of a Micro-Fog lubricator illustrating the principle of oil atomization.

Courtesy of Hills-McCanna Company

Figure 7 — Ratchet-drive force-feed lubricator with single feed outlet.

is to be lubricated and see that it is lubricated properly. The application of lubricants to modern equipment should be as independent as possible of the human element.

Consequently, wherever possible, consideration should be given to the use of mechanical means of applying lubricants. There are many varieties and types of equipment available, ranging from devices to lubricate a single bearing to fully automatic central systems capable of lubricating all of the machines in the plant. The benefits to be realized from controlled lubrication are many and have been well established. Some of them are outlined briefly as follows.

Lower Operating Costs

One of the big advantages of the use of modern methods of applying lubricants is the reduced cost of application. Years ago it was economical to lubricate machinery by manual methods. Today labor is not cheap. In one plant where manual lubrication was still being used, it was estimated that it was costing $4.00 in labor to apply $1.00 worth of lubricant. The total annual labor costs for applying lubricants in this plant ran close to $110,000. The use of modern methods of application could have slashed this figure substantially, and at the same time reduced lubricant costs, since manual application invariably is accompanied by waste.

Less Downtime

In plants which still rely on manual methods of applying lubricants, much valuable time is lost because of the necessity of stopping machines to apply the lubricant. As an example, in an automotive plant it was found that it required an oiler 18 minutes to lubricate a cylinder block boring machine. Multiply this by the number of machines in a plant and the number of lubrication intervals per day, and it is readily apparent that the amount of expensive "time-out" for lubrication could be appreciable.

The Right Amount At The Right Time

How much lubricant and how often? The answer to this, of course, depends on the size and type of bearing, the load and speed and the environment. For each bearing and set of operating conditions, there will be an optimum quantity of lubricant that should be applied and an optimum lubrication interval. For example, a large high-speed drive shaft may require a shot of oil every few minutes. A small bearing may need only a drop of oil every hour or so. Outmoded hand lubrication methods invariably will produce a feast or a famine, either one of which can produce some very unpleasant, if not disastrous, consequences. Modern methods of application assure that each bearing gets its quota of lubricant, and only its quota, at the proper time.

No Guess Work

It is not uncommon for a complex piece of machinery to have over 200 bearings. Experience has shown that it is impossible for any crew of oilers, regardless of how conscientious they may be, to lubricate these bearings manually with any degree of accuracy. Here the old adage "Out Of Sight Out Of Mind" is working overtime. With modern methods of application, however, all bearings, not just the obvious ones, are lubricated.

No Inaccessible Bearings

In addition to bearings hidden from view, many bearings or other parts to be lubricated are practically inaccessible to manual lubrication. In order to lubricate these points, the equipment must be partially dismantled, which not only is a nuisance, but also takes up valuable time. With modern methods of application there are no inaccessible bearings.

No Contamination

A good portion of equipment maintenance costs can be attributed directly to a contaminated lubri-

cant. Manual methods of application invite contamination. Modern methods of application practically preclude it.

Promotes Safety

All plants are becoming more safety conscious. It is generally forbidden to lubricate a machine manually while it is in operation. Frequently the rules are overlooked, and in these cases lubricant application is a definite hazard.

Even when the machines are stopped, it may be necessary for the oilers to climb ladders, sometimes at dizzy heights, to lubricate a bearing.

With manual methods of application the lubricant is not always confined to the bearings. The machine surfaces are usually covered and the floors become oil soaked, presenting another hazard.

Modern methods eliminate these hazards.

These, then, are some of the obvious benefits to be realized by controlled application of lubricants, all of which will contribute handsomely toward reduced costs and increased production.

Preventive Maintenance

Preventive Maintenance, properly handled, must be a part of any sound lubrication program. Although the lesson has been learned the hard way, experience has proven that in the long run it pays to take care of equipment on the job and not neglect it. A program of preventive maintenance, well planned and properly executed, will pay for itself over and over again. For example, it is much cheaper to keep a bearing adjusted than it is to buy new bearings, shafts, and gears that become damaged when unadjusted bearings fail. Major breakdowns, lost time, and high operating costs can be kept to a minimum by keeping parts lubricated, tightened, and adjusted. Furthermore an operator whose equipment is always in good condition is very apt to be a happy, satisfied employee.

TYPICAL EXAMPLES

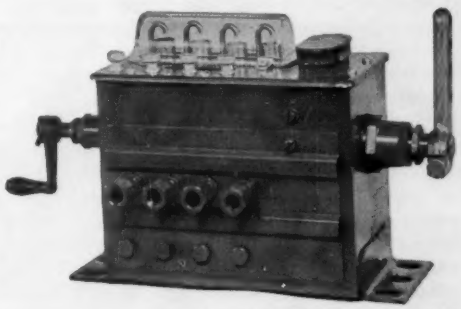
Not only do the arguments for organized plant lubrication appear reasonable but they are firmly supported by actual experience. Evidence continues to accumulate, all of which testifies to the overwhelming success of planned lubrication wherever it has been tried. Some typical examples of what can be accomplished are described briefly as follows.

First Example

A plant was experiencing lubrication problems due to a combination of the complexity of the equipment and certain seniority rules[1]. An "oiler" was in the lowest job classification and received the lowest rate of pay. Any new, inexperienced employee was assigned to this job. As he acquired experience and seniority, he would be transferred to a job of higher classification. This meant that there was always a rapid turnover among the oilers and furthermore that they were always the least experienced of the plant personnel. There was little opportunity to train individuals for the important job of lubrication.

As an example of the type of equipment that had to be lubricated, a certain grinder required one type of lubricant in 22 places daily, another type in one place daily, a third type in six places weekly, a fourth type in one place weekly, a fifth type in one place weekly, and a sixth type in six places semiannually. Since there were about 250 machines in the plant, it is apparent that, under the circumstances, there was a real problem in applying the right lubricant to the right place at the right time. Several years ago, a lubrication program was initiated which was designed to improve the situation with respect to application of lubricants and to minimize the chances of error.

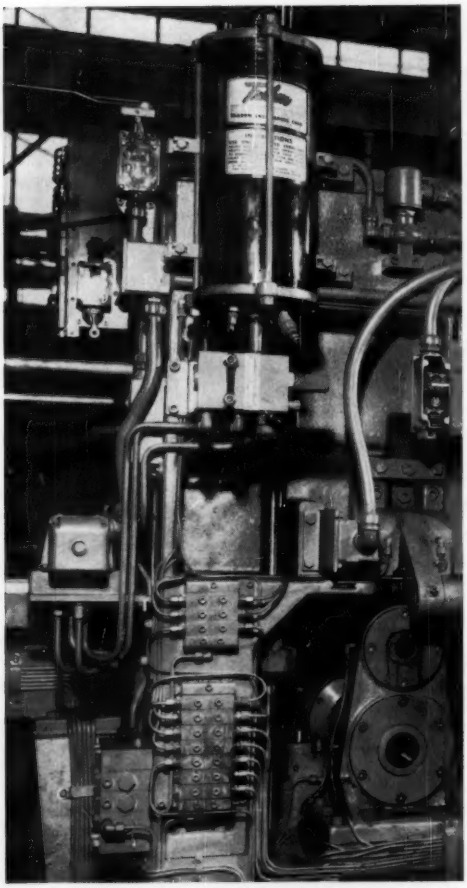
The heart of the program is a code system for identifying each lubricant and each lubrication point on a machine where it was to be applied. Briefly, each lubricant is assigned a code which is simply a colored symbol, such as a red cross, a yellow square, a green triangle, etc. This assigned code is painted on top of a drum of lubricant upon receipt from the supplier, and thereafter the lubricant is identified by its code rather than its name. Any containers used for intermediate transfer of the lubricant from the drum to the machine also bear the code designation. Thus, a given container is used for only one type of lubricant. Each point to be lubricated on an individual machine is identified by the symbol representing the lubricant to be used. Finally, a card inserted in a plastic envelope attached to each machine specifies the different lubricants, by symbol, required for that machine.



Courtesy of Madison-Kipp Corporation

Figure 8 — Ratchet-drive force-feed lubricator with four feed outlets.

[1]See bibliography, last page.



Courtesy of Trabon Engineering Corp.

Figure 9 — Combination Automatic Grease and Oil Lubrication on a Machine Tool.

also the number of points where each lubricant is to be applied and whether the frequency of application is daily, semiweekly, weekly or semiannually. Duplicate sets of cards are kept in the office for use in setting up the daily lubrication schedules for the oilers.

At the beginning of the day, each oiler is given a check sheet which identifies the machines he is to service. The sheet also indicates whether points on any of the machines requiring semiweekly, weekly or semiannual lubrication are to be serviced that day. The oiler fills the containers on his cart with lubricant from the drums which are on a special rack in the storeroom, matching the symbol on the container with that on the drum. Before servicing a machine, he consults the attached card to determine the daily lubrication requirements. Suppose, for example, under the column headed "daily" there is a red cross with the number 8 after it and a green triangle followed by the number 3. This means that there are eight lubrication points that require the lubricant identified by the red cross and three points for the lubricant with the green triangle. Since the actual points on the machine are also identified by the corresponding code, the oiler merely has to locate the various points, eight red crosses and three green triangles, and lubricate them accordingly. When he has completed servicing all of the points requiring daily lubrication, the oiler checks his schedule sheet to determine if elements other than the daily requirements are to be serviced that day. If the schedule shows that the weekly points are also to be lubricated, he again consults the card attached to the machine and looks under the column headed "weekly" to determine the lubricants required and the number of points to be lubricated. As the lubrication of each machine is completed, the oiler checks it off on his schedule sheet. When he has serviced all of the machines listed, he signs the sheet and turns it in. Although this system is not entirely foolproof since it does rely on the human element to an appreciable extent, it has eliminated practically all of the potential sources of errors except those due to carelessness. Furthermore, it minimizes the need for experience and permits satisfactory application of lubricants to be accomplished by the novice.

In conjunction with the lubrication program, a preventive maintenance plan was also inaugurated. This provides for a daily check of each machine by an experienced repair man. Among other things, all the lubrication fittings are inspected to be sure they are in proper condition.

The records show that the combined lubrication and preventive maintenance programs have been very effective. The life of machine parts has been extended appreciably and substantial savings have been realized both in the cost of the lubricants and the cost of maintenance. The number of lubricants used was reduced from 32 to 9, and lubricant costs were cut by about 30%.

Second Example

This will summarize how a medium sized manufacturing plant reorganized its lubrication practices and discuss briefly the results which were achieved.[2]

Prior to the reorganization, the lubrication practices that were being followed were far from ideal. There was very little, if any, standardization throughout the plant. The foreman of each department was responsible for lubrication of the equipment in his area. He determined what lubricants were going to be used and where and how often

[2]See bibliography.

they would be applied. Storage and handling of lubricants was such as to invite contamination. There was a good possibility of oil being pumped into wrong storage containers, with the consequence that machines were not being lubricated with the proper product. Furthermore, the department foremen were not lubrication experts and could not be expected to devote the proper attention to lubrication matters. The actual lubrication was performed by the individual machine operators and, of course, there was a great variation here in the efficiency with which the job was done.

All in all, there were many reasons why a reorganization of lubrication practices was needed, and management was solidly behind the plan. Among the goals expected to be attained by the lubrication program were increased machine tool life, decreased cost of lubricants and decreased labor costs.

The first step in organizing the program consisted of renumbering the machines and equipment in a systematic manner. Brass tag plates containing the machine number, manufacturer's name, and the division name were affixed to each machine. Also two sets of cards were made out for each machine, one called an Equipment Record Card and the other an Electrical Equipment Record Card.

Since the plant did not have a lubrication engineer, assistance was requested from the lubricant supplier in making a survey of the lubrication requirements. The engineer from the supplier conducted the survey, keeping in mind the desire to consolidate the number of lubricants where possible. All of the information necessary to lubricate the machines satisfactorily was duly recorded and tabulated. Codes were established for the various lubricants to be used as a means of identification at the point of application.

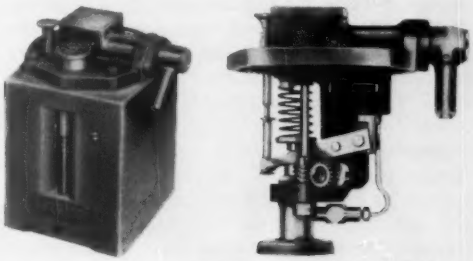
Since the success of the project was going to depend to a large degree upon the cooperation of everyone concerned, an orientation program was arranged. This consisted of a series of lectures by the lubrication engineer from the lubricant supplier. The lectures covered all aspects of the lubrication program and were given to all production and maintenance supervisors.

After reviewing the equipment to be lubricated, it was decided that two oilers could service the machine tools for the entire plant. A job description was prepared which resulted in a high level classification, requiring experienced personnel to fill these posts. This made it possible to select men of the highest caliber, and they were thoroughly trained before starting their assignments.

New storage facilities were arranged and new practices for handling lubricants were initiated, designed to reduce the chances of contamination. Wherever possible, lubricants were now stored in their original containers and transferred directly to the cans and grease guns used to apply them.

Each oiler had his own lubrication cart which contained all of the equipment he needed in making his rounds of the machines. The carts were designed especially for this purpose, and in addition to having space for all of the containers and guns, they contained a cabinet with several drawers for such things as fittings and clean rags. Lubrication cards, one for each machine, were also kept in the cabinet. They contained all of the information the oiler needed to know in order to lubricate a machine, and each card was kept in its own clear plastic folder. Duplicates of these cards were kept in the plant maintenance office. As the oiler made his rounds, he recorded his activities on a standard form with which he was provided. He also made a note of any unusual conditions that he might encounter. These completed forms were reviewed daily by the supervisor for any action that might be required.

Based on nine months experience, the program is working very well and is paying off in several respects. The number of lubricants used in the plant has been reduced by 50%. This has simplified ordering, storage and inventory problems. Also, it has brought to light that servicing of the hydraulic reservoirs had been very bad. Many contained fluid that was obviously contaminated and usually the fluid levels would be low. Also, numerous leaks were discovered. These conditions were all corrected. Direct dollar savings have resulted in the cost of actually applying the lubricants. Before starting the new program, the machine operators were paid an allowance for lubricating their machines and also for keeping the machines clean. Although they are still required to keep the machines clean, the reduction in the allowances paid to the operators more than pays the salaries of the oilers. The operators are happy with the new arrangement since they can devote the previous maintenance time to production and thereby make more money. In fact, the whole morale throughout the plant is on a higher level. Also the



Courtesy of Bijur Lubricating Corp.

Figure 10 — Automatic lubricator showing details of pump.

oilers are of great aid to the maintenance department by reporting points of potential trouble.

Although considerable effort was required to design this program and set it in motion, all concerned feel that it was more than worth it. It is also felt that the role of management in backing the program to the hilt was vital to its success.

Third Example

A survey of lubrication practices in a large automotive parts manufacturing plant revealed some astounding examples of malpractices which were resulting in exorbitant costs.[3] It was found that the machines were equipped with just about every type of grease and oil fitting ever designed. This meant a comparable array of grease guns and oil cans were required. It was not unusual to find a machine in one department equipped with oil cups, the same machine in another department equipped with grease fittings and in still another department, the machine would have both oil cups and grease fittings. The lack of standardization resulted in very haphazard, and inadequate application of lubricants. As a result, downtime for bearing replacements and general maintenance practices was excessive. Some of the specific examples of the problems encountered and the corrective measures taken are discussed briefly as follows:

Sixty multiple-index type machines had been in operation for about ten years and the downtime was excessive, causing loss of production and high maintenance costs. The operator of each machine was given a grease gun and was allowed 15 minutes on each shift to lubricate 21 points on the machine. The results of the survey showed that these expensive machines either were being lubricated improperly or were not being lubricated at all. The reasons for this situation were numerous and varied: neglect on the part of the operator; new operator not properly instructed as to his responsibility; grease gun lost or misplaced; no grease on hand; fittings plugged, damaged or missing. The corrective measure consisted of installing centralized lubrication systems on these machines and relieving the operators of the responsibility for lubrication. The results that followed were amazing. Maintenance costs, including labor and material, were reduced 60% or $72,000. Production was increased 20%. The quality of the work was consistently better. There was a substantial reduction in scrap.

Another troublesome unit was a gas-carburizing furnace which had 20 plain bearings. Grease was applied by means of a hand gun into a manifold and out through tubing to bearing points that ranged from 10 to 72 inches from the manifold. This method was most inadequate. The points close to the manifold received too much grease and those furthest removed received none. Because of this, maintenance costs and downtime were excessive. The installation of a semi-automatic central pressure system resulted in direct maintenance labor savings of $1200 per year, savings in bearing material of about $600 per year, elimination of one hour per day lubrication allowances which were equivalent to $580 per year, and an increase in production of 13%.

A chip crusher required the attention of one full time maintenance man to make minor repairs and lubricate the equipment. Even with this constant attention, it was necessary to recondition the unit and replace parts at intervals of three months when the equipment would be out of service for 40 hours. A semi-automatic central pressure system was installed with the result that the three month reconditioning period was eliminated and the full time of a maintenance man was not required. The savings in labor and parts amounted to over $6500 a year.

Replacing hand lubrication by centralized systems on five vertical turret lathes, five automatic turret lathes and six special precision double end boring machines saved over $4500 annually in direct labor costs. This is but a small part of the overall savings when compared to the increased production, reduction in scrap, better quality of work and increased equipment life.

SUMMARY

Ideal lubrication is the application of the right amount of the right lubricant to the right place at the right time. Organized plant lubrication represents an attempt to make the practice of lubrication conform to the ideal. Contrary to the general concept, organized lubrication of plant equipment is actually a cost saving device. The amount of cash savings and other benefits that can be realized depend upon how closely the actual practice of lubrication approaches the ideal.

Millions of dollars have already been saved in the operating costs of plants where management has recognized the importance of lubrication and has organized planned lubrication programs. Millions of dollars are waiting to be saved in plants where management has not yet become aware of the benefits of organized lubrication.

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[3] From a paper presented by R. C. Lohbauer at 1955 annual meeting of American Society of Lubrication Engineers, Chicago.

[3] See bibliography.

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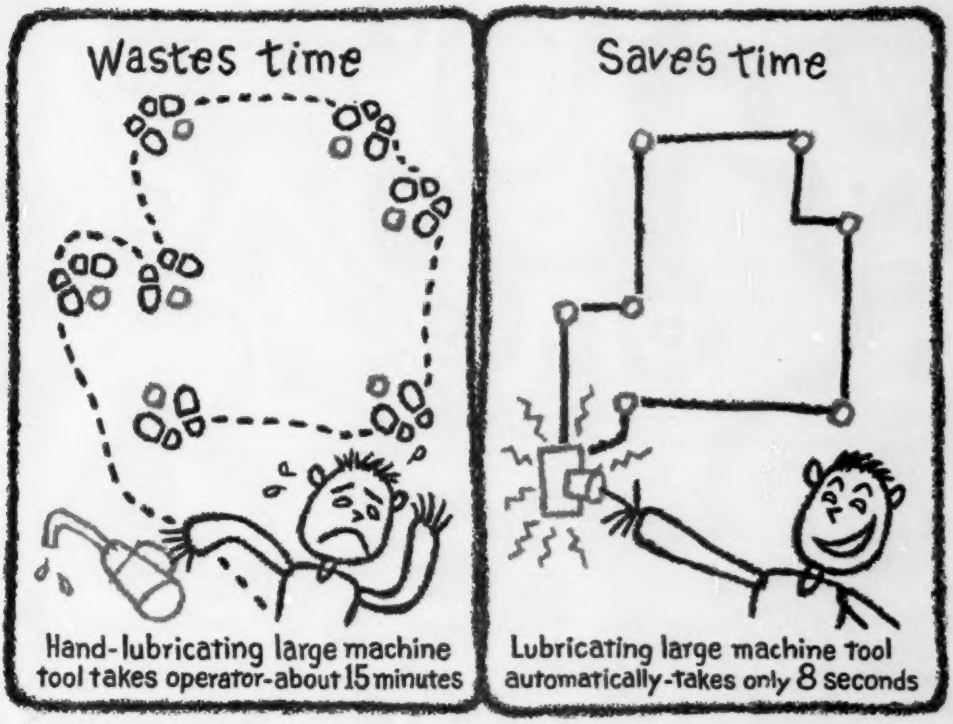

Central lubrication cuts waste of manhours—in one case, 315 a month

Recent management surveys into plant lubrication practices have turned up some astounding opportunities for over-all savings. In a single plant these savings included a 60% reduction in maintenance expense and a 20% increase in production.

This particular study covered 60 machine tools performing turning, boring, drilling and reaming operations. Each operator lubricated his own machine with a hand gun and was allowed fifteen minutes per eight hour shift to do so—a total of 315 manhours.

But for one reason or another at least some of the twenty-one lubricating points on every machine were either improperly lubricated or had not been lubricated for a long time. These conditions were corrected by installing a central system on each machine, enabling the operator to spend all his time on productive work. Result—tremendous savings and greatly improved operation.

This experience is typical of the benefits that can be realized when management recognizes that organized lubrication is a major factor in cost control.

Let Texaco's organization of Lubrication Engineers, operating in all 48 states, help you. A more detailed discussion is available in an enlightening booklet: "Management Practices That Control Costs Via Organized Lubrication." Write:

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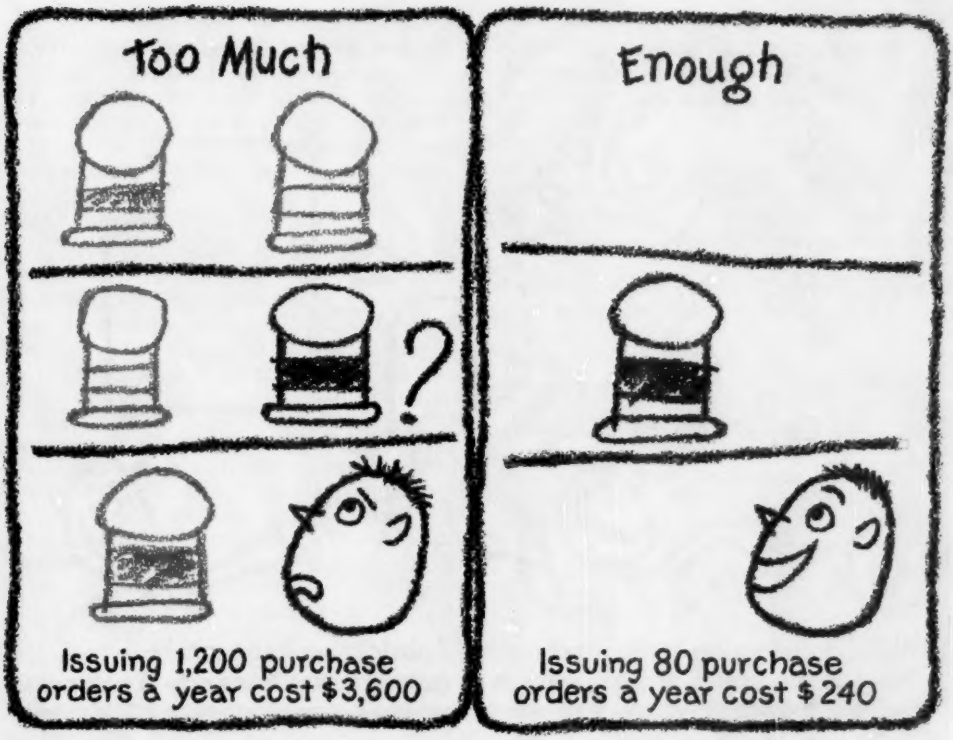

Lubricant survey cuts cost of purchasing—in this case, 93%

One manufacturer estimates that it costs him $3 to initiate a purchase order. Investigation showed that it took some 1,200 such orders a year to maintain his inventory of 100 different lubricants—or $3,600 in ordering costs. He instituted a survey. As a result, the number of different lubricants stocked was dropped to 20. Quarterly purchasing intervals were also recommended. Purchasing cost then sank to a mere $240 per year—an annual saving of $3,360.

No wonder industry is feeling a rising need for management planning of lubrication programs. Texaco's organization of Lubrication Engineers can offer specific assistance in all 48 States. A more detailed analysis is available in an enlightening booklet: *"Management Practices That Control Costs Via Organized Lubrication."* Write:

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